

US EPA ARCHIVE DOCUMENT



Can the Ecological Constraints Model inform us about nesting tactics in a primitively eusocial wasp?

Abstract

The Ecological Constraints Model (ECM) has successfully identified a variety of factors that can explain the evolution and expression of cooperative breeding. As a part of the study, density has been implicated in the expression of cooperative breeding. In this study, I tested whether density could explain the proportion of haplometrotic and pleometrotic nests in the eusocial paper wasp, *Mischocyttarus mexicanus*. *M. mexicanus* is particularly appropriate to address this issue because nests are initiated throughout the year and multiple nests are initiated in the same tree (*Sabal palmetto*), making discrete estimates of density in a natural environment possible. During an 18-month census, I found that solitary females were negatively correlated with density. This pattern was then tested experimentally by adding or removing palm fronds from *S. palmetto* and then reinitiating nests. The percentage of solitary females decreased when fronds were removed (high-density treatment), increased when fronds were added (low-density treatment), and remained unchanged in the control treatment. The percentage of all females emigrating from a tree and the average number of females per pleometrotic nests was the same for each treatment (Not shown). Together these data suggest that solitary females joined social nest in poor environments, which is consistent with the ECM.

Research Highlights

Ecological Constraints Model (ECM)

- Animal should behave cooperatively in poor environments
- Altruism ↑ with ↑ density

Mischocyttarus mexicanus nesting tactics

Solitary Nesting



Social Nesting

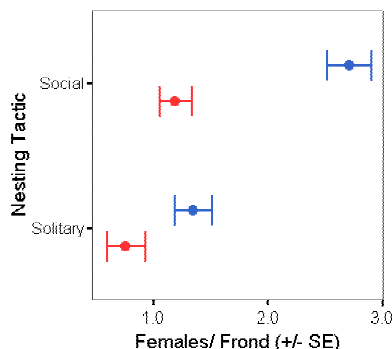


- Evidence of Altruism
- Reproductive Skew
- Division of Labor

Does density affect *M. mexicanus* nesting tactic?

- 93 % of nest initiated on empty palm frond
- Aggression is common and more intense among non-nestmates

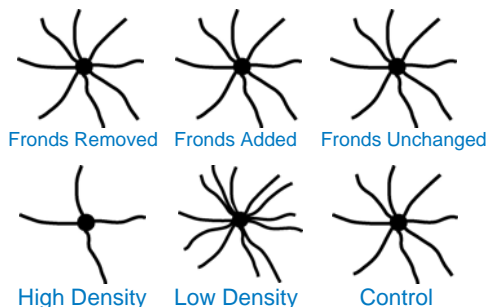
- Field Observation
 - 18 month bi-weekly census
 - 244 new nests sampled



Nesting tactic & density correlated negatively

Field Experiment – Methods

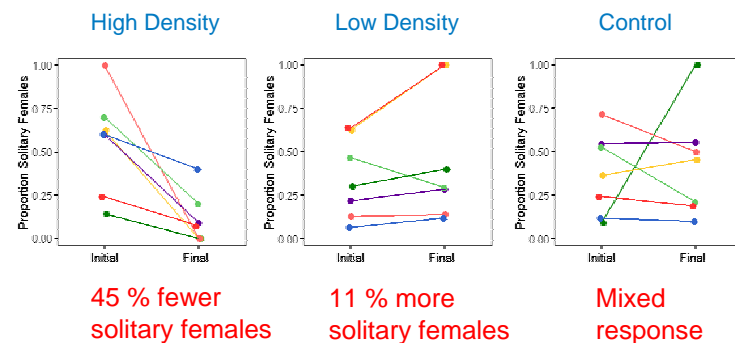
- Top-down view of sabal palm modifications



- Day 1
 - Grouped trees
 - Census
- Nests removed
- Day 14
 - Census

Field Experiment – Results

- Lines represent change in individual trees



Impact

Summary

- Field Observation
 - Nesting Tactic was negatively correlated with density
- Field Experiment
 - Density affected nesting tactic

Are these observations consistent with the ECM?

- Yes; females bred cooperatively in poor, dense environments

- Undergraduate Assistance
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